ECOLOGICAL REFLECTIONS ON THE WADING BIRDS OF THE DOMINICAN REPUBLIC: REPORT OF A SURVEY CONDUCTED IN THE SUMMER OF 1987

Jean-Luc DESGRANGES
Réjean BENOIT

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ABSTRACT

During a short visit to a number of wetlands in the Dominican Republic on the island of Hispaniola, we sighted thirteen species of wading birds. These can be divided into three groups, depending on whether they occur primarily in saltwater habitats, freshwater habitats or both saltwater and freshwater habitats. The Hispaniola population of these birds could decline substantially unless measures are taken to prevent poaching, loss of habitats and degradation of wetlands caused by pesticides.

RÉSUMÉ

Une visite rapide de plusieurs milieux humides de la République dominicaine sur l'île d'Hispaniola nous a permis d'observer treize espèces d'échassiers. Celles-ci se répartissent en trois groupes selon qu'elles fréquentent principalement les habitats salins, les habitats d'eau douce ou les deux types de milieux à la fois. Les populations dominicaines et haitiennes de ces espèces pourraient connaître des déclins importants si aucune mesure n'est prise afin de limiter le braconnage, la perte des habitats et la dégradation des milieux humides par les pesticides.

RESUMEN

Durante una breve visita a varios humedales de la Republica Dominicana, observamos trece especies de aves zancudas que podian dividirse en tres grupos segun viviesen primariamente en medios de agua salada, agua dulce o ambas, dulce y salada. La poblacion de estas especies en toda la isla Santa Domingo podria disminuir grandemente, a menos que se tomasen medidas para evitar la caza furtiva, la pérdida de los habitats y la degradacion de los humedales por pesticidas.

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1.0 INTRODUCTION

The survey we conducted in the Dominican Republic forms an integral part of a more extensive research project to determine the levels and sources of contaminants present in Great Blue Herons which nest along the St. Lawrence corridor in summer. Our ultimate objective is to develop a bio-monitoring technique for evaluating the success of the various measures taken to clean up the St.Lawrence River. The development of such a technique would be incomplete if we did not measure the contaminants accumulated by the Great Blue Heron on their tropical wintering sites.

During the boreal winter, large numbers of Great Blue Heron migrate to the coastal regions of the Caribbean sea (Wetmore and Swales, 1931; Wetmore, 1932; Palmer, 1962; Bond, 1971; Byrd, 1978; Stockton de Dod, 1981, 1987; Anonimo, 1983; Hancock and Kushlan, 1984). A mail survey of neotropical ornithologists and the examination of banding data confirmed the presence of a large number of Great Blue Herons in the Greater Antilles, mainly in winter (Alberto R. Estrada, Douglas W. Mock, Annabella Stockton de Dod, José A. Ottenwalder and James W. Wiley, pers comm.). The sighting of several adults and juveniles in the spring and summer suggests that this species may nest in Hispaniola (Wetmore and Swales, 1931; Anonimo, 1983; José A. Ottenwalder, pers. comm.) and in Cuba (Alberto R. Estrada, pers. comm.).

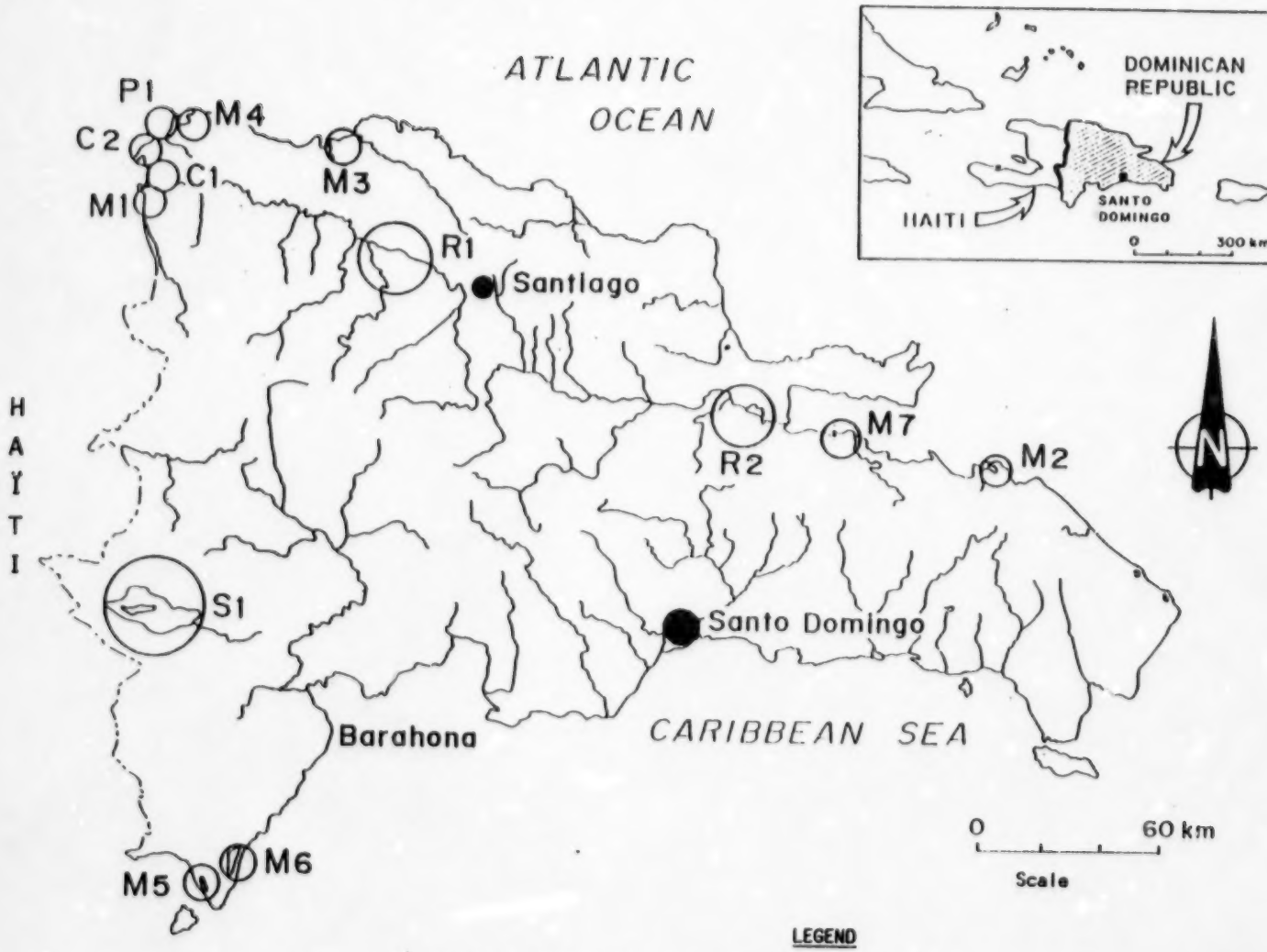
The presence of nesting colonies of Great Blue Heron in the Greater Antilles would provide an exceptional experimental framework. The study of the contamination of a resident population of Great Blue Heron could facilitate the detection of the type and quantity of toxic chemicals to which migratory populations are exposed during their winters in the tropics.

2.0 ORNITHOLOGICAL SURVEYS

In co-operation with Dr. J. A. Ottenwalder ("Direccion general de parques), Tomas A. Vargas Mora (Departamento de vida silvestre) and Annabelle Stockton de Dod (author of two books on the birds of the Dominican Republic), we prepared a list of the areas that were likely to be frequented by wading birds. We were issued permits to stay in the parks and to collect eggs by the authorities concerned ("Direccion general de parques" and "Departamento de vida silvestre").

Two types of survey were planned: a flight over the southwest part of the country, which is inaccessible by road, and a survey, by boat or on foot, of other areas frequented by aquatic birds. We surveyed thirteen sites, which were divided into five distinct ecosystems, two of which were artificial.

A brief description of the ecosystems surveyed follows. The geographical location of the sites visited is shown in Figure 1.



LEGEND

MARSHES	M 1 – Laguna de Saladilla M 2 – Laguna Limon M 3 – Laguna Grande	SHRIMPS PONDS	C 1 – Los Conucos C 2 – Punta Morro	MANGROVE SWAMP	M 4 – Laguna de la Piedra M 5 – Laguna Salada M 6 – Laguna de Oviedo M 7 – Los Haitises
RICE FIELDS	R 1 – Santiago Valley R 2 – Vega Real Valley	INTERTIDAL ZONE	P 1 – Monte Cristi	SALINE LAKE	S 1 – Lago Enriquillo
		CITY .	CAPITAL .		

PLATE 1: Geographical location of the sites visited.

- A mangrove swamp is a flooded saline forest located along the sea coast and characterized by the presence of one or more species of mangrove tree (red mangrove Rhizophora mangle, black mangrove Avicennia germinans, white mangrove Laguncularia racemosa and "Botancillo" mangrove Conocarpus erectus) (Anonimo, 1983). Four of the sites surveyed were mangrove swamps: Laguna de la Piedra, Laguna Salada (a permanent brackish coastal lagoon), Laguna de Oviedo (a permanent highly saline coastal lagoon) and Los Haitises.

- The intertidal zone is the portion of the seacoast which is not characterized by mangrove swamp, but which is nevertheless used by wading birds for feeding. The area of mud beaches at Monte Cristi is the sole representative of this ecosystem in this study.

- Marshes are freshwater ecosystems. The emergent vegetation which grow in these lowlands belongs to the following genera: Thypa sp (cattails), Sagittaria sp (arrowhead), Lemna sp, and (duckweed) Nymphaea sp (water-lily), to name a few. We explored three marshes: Lagunade Saladilla (a permanent shallow fresh water lake to brackish lake), Laguna Limon (a permanent freshwater lake) and Laguna Grande.

- The fourth natural ecosystem we visited was Lago Enriquillo, a permanent hypersaline lake. It was formerly an arm of the ocean, and was cut off from the sea following the upthrust of the continental shelf. The salinity of the water varies from 40 to 90 ppt (Hernandez

and Vargas, 1986), and provides a habitat for a small non-nesting colony of flamingos (Stockton de Dod, 1987). A small population (175-250 individuals) of American crocodiles (Crocodylus acutus) also occurs in Lago Enriquillo (Hernandez and Vargas, 1986). We counted only seventeen crocodiles in an aerial photograph taken during our aerial survey of the lake.

- Rice fields form a very extensive artificial ecosystem in the Dominican Republic. The large-scale production of rice results in the formation of vast expanses of slightly flooded land with many canals, in which a number of wading bird species occur. We visited two regions where rice production is widespread: Santiago Valley and the Vega Real Valley.

- Shrimp culture ponds also form an important ecosystem for wading birds. They consist of artificial shrimp cultivation tanks located near the sea. The abundance of shrimp attracts a very large number of wading birds, even though the depth of the ponds and the steep slope of their sides actually leave only a thin strip where the birds can feed. The two ponds visited, Los Conucos and Punta Morro, are located in the area of Monte Cristi.

3.0 RESULTS

3.1 Habitat preferences of wading birds

The results of our surveys of wading birds at the thirteen sites visited are presented in Table 1. The sites (columns) and species (rows) are based on a multidimensional cluster analysis using Jaccard coefficient (Legendre and Vaudor, 1982; Legendre and Legendre, 1984). The two dendrograms produced are provided in Appendices 1 and 2. The matrix which was used for the analysis is a matrix of the presence or absence of the various species at each site visited.

There are three main groups of wading birds. The first group includes species which occur in saltwater areas only. These species are the Roseate Spoonbill, Glossy Ibis, Greater Flamingo, Great Blue Heron and Reddish Egret (see Appendix 3 for scientific names of birds). A second group comprises species which use both saltwater and freshwater habitats. It includes the Tricolored Heron, White Ibis, Great Egret, Snowy Egret, Little Blue Heron and Cattle Egret. The third group comprises those species which prefer freshwater habitats, and includes the Black-crowned Night Heron and Green-backed Heron.

TABLE I

Number of wading birds sighted at the various locations under study

SITES / SPECIES	Laguna de Saladilla	Laguna Grande	Vega Real Valley	Santiago Valley	Laguna Limon	Los Conucos	Laguna de la Piedra	Punta Morro	Monté Cristi	Los Haitises	Laguna de Oviedo	Laguna Salada	Lago Enriquillo	Total specimens	Number of sites
Black-crowned Night Heron	8	0	0	0	0	0	0	0	0	16	0	0	0	24	2
Cattle Egret	100	150	P	P	0	P	P	0	2	30	125	0	0	407	9
Green-backed Heron	3	8	P	2	1	0	3	5	P	P	0	0	0	22	9
Great Egret	0	0	10	1	1	4	10	12	1	20	1	20	1	81	11
Little Blue Heron	0	0	0	0	1	1	15	5	1	2	0	0	0	25	6
Snowy Egret	0	0	0	0	0	30	100	35	2	10	125	50	0	352	7
Tricolored Heron	0	3	0	0	0	1	25	5	0	30	0	0	7	71	6
Great Blue Heron	0	0	0	0	0	0	2	0	0	0	0	8	1	11	3
Roseate Spoonbill	0	0	0	0	0	0	1	0	0	0	1	0	25	27	3
White Ibis	0	0	0	0	0	0	15	2	0	0	25	0	0	42	3
Reddish Egret	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1
Glossy Ibis	0	0	0	0	0	0	0	0	0	0	0	0	10	10	1
Greater Flamingo	0	0	0	0	0	0	0	0	0	0	35	200	75	31	3
Total (specimens)	111	161	10	3	3	36	171	64	6	108	312	278	120	651	
Number of species	3	3	3	3	3	5	9	6	5	7	6	4	7	13	

The Great Egret, Cattle Egret, Green backed Heron and Snowy Egret were the most commonly sighted species, while Reddish Egrets, Glossy Ibises and Black-crowned Night Herons were quite scarce. The most abundant species were the Cattle Egret (407 specimens) and the Snowy Egret (352 specimens). The most abundant species sighted in a single location was the Greater Flamingo, with 200 specimens sighted at Laguna Salada. More species (4 to 9) and specimens (6 to 313) were sighted at the eight saltwater areas than at the areas of brackish water or freshwater (3 species, and 3 to 161 specimens).

The dendrograms in Appendix 1 and 2 reveal the existence of three main clusters of species and of two principal site cluters. All thirteen species inhabit saltwater environments, with only six species also frequenting areas of brackish water or freshwater. The absence of species that inhabit freshwater only is probably the result of the scarcity of freshwater wetlands, not only in Hispaniola, but throughout the Antilles. The shortage of suitable habitats may have hindered the colonization of the essentially freshwater species of wading birds of North and South America (Kushlan et al, 1985).

3.2 Search for nesting colonies

During our flight over the Barahona peninsula on July 28, we sighted two colonies, one at Laguna de Oviedo, and the other (much smaller) at Laguna Salada. The colonies consisted mainly of Snowy Egrets and

White Ibises. As far as we could tell from the air (the pilot had to maintain high speeds because of the high winds), nesting appeared to be almost over. Anonimo (1983) states that 100 pairs of Tricolored Herons breed in February in Laguna Salada and that ten active nests were still there in August.

Throughout our visit, we questioned fishermen and residents regarding the presence of wading bird colonies in their area. A fisherman from Monte Cristi took us to a colony located deep within the mangrove swamp of Laguna de la Piedra. There we found many Snowy Egret nests, which were empty except for a single undeveloped egg found in each of two nests. We also sighted two young Snowy Egrets about to take their first flight. The fisherman, who collected eggs in this colony, told us that nesting in this location generally began in mid-May.

Finally, we found nests of Great Egrets, Tricolored Herons, Snowy Egrets, Cattle Egrets and Black-crowned Night Herons on two islands in Los Haitises national park. Because these islands are relatively small, the colonies contain few nests. In each case, nesting was almost over, since the young had already left their nest and were moving from tree to tree within the colonies.

4.0 CONSERVATION PROBLEMS

4.1 Scarcity and disappearance of wetlands

The island of Hispaniola is very hilly, resulting in the rapid drainage of rainwater toward the coasts. Consequently, the interior lakes and rivers comprise less than 1 per cent of the total area of the Dominican Republic (399 km² of 48,442 km²) (Hart- shorn et al., 1981). In the deltas of the main rivers, there are a number of marshes (269 km²; 0.6 per cent) which gradually disap- pear, and are replaced by rice fields. Over the past ten years, through an intensive drainage program for farmland located along the country's major rivers, the area of rice fields has increased by 59 per cent, and today totals 1,200 km² (2.5 per cent of the total area) (Table 2). A number of vast mangrove swamps grow at the mouth of the rivers in the thick layer of sediment which has been transported by the rivers and precipitated when it came into contact with the salt water. This important habitat for colonial water birds covers some 100 km² and accounts for just over 0.2 per cent of the country's total area (Hartshorn et al, 1981).

As we have already seen, many species of wading birds occur in the wetlands of the Dominican Republic. The number of individuals of some species, such as Cattle Egrets and Snowy Egrets, may be substantial. Nesting colonies often prefer mangrove swamps, while the marshes are used by both wading and migratory birds primarily for

TABLE 2

Principal crops of the Dominican Republic

Crops	Area under cultivation in 1987[a] (ha)	Percentage of land under cultivation (%)	Change in production (in hundreweight) from 1976 to 1985 (10 years)[b] (%)
Fields			
Beans	140,000	18%	+ 118%
Rice	120,000	16%	+ 59%
Maize	45,000	6%	+ 37%
Plantations			
Coffee	150,000	20%	+ 140%
Cocoa	120,000	16%	+ 28%
Bananas	42,000	5%	+ 17%
Total (all crops)	760,000	100%	+ 3%

a) Estimates based on Table 4 in Anonimo (1986) (1 ha = 15.9 tareas)

b) Estimates based on Table 104 in Anonimo (1986)

feeding. These two environments are extremely important for aquatic birds and must be protected. At present, the felling of mangrove trees in a number of swamps for the production of charcoal is unregulated (Anonimo, 1983; Hernandez and Vargas, 1986). We have not been able to evaluate the extent of this activity, but we have observed the deterioration of vast areas of mangrove forests in the region of Monte Cristi (in the northwest part of the country), where a major port is now being built (Manzanillo) and where a growing number of shrimp culture ponds and saltworks are being established. The situation of marshes is even more critical, for they disappear completely and are replaced with rice fields. Since large wading birds, such as migratory Great Blue Herons (Annabelle Stockton de Dod, pers comm) and Great Egrets inhabit primarily marshes and seldom frequent rice fields, the gradual disappearance of the country's few marshes poses a serious threat to the survival of resident and migratory populations of these species.

4.2 Poisoning by pesticides

The increase in the total area of farmland has been accompanied by a substantial rise in the use of pesticides. Since 1972, close to 800 products have been added to the list of pesticides used in the Dominican Republic. From 1984 to 1986, pesticide sales rose from $1.3 million to $2.1 million (Canadian), an increase of 57 per cent (Table 3). Insecticides account for the major share of this increase, with a rise in sales of 140 per cent. Herbicide sales increased by 31 per cent and totalled more than 56,000 gallons in 1985.

TABLE 3

Main types of chemicals presently used on farms in the Dominican Republic

Products	Total sales in 1984[a] (Can $000)	Percentage of sales in 1984	Total sales in 1986[b] (Can $000)	Percentage of sales in 1986	Percentage of increase in sales 1984-1986
Fertilizers	690	34%	625	23%	- 9%
Pesticides	1350	66%	2125	77%	+ 57%
Herbicides	675	33%	885	32%	+ 31%
Insecticides	405	20%	970	35%	+140%
Fungicides	270	13%	270	10%	0%
Total	2040	100%	2750	100%	+ 35%

a) Estimates based on Table 15 in Anonimo (1985) (Can $1 ≃ D. Pesos 2.5)

b) Estimates based on Table 29 in Anonimo (1986)

Table 4 provides a list of very toxic pesticides presently used in the Dominican Republic. Four of these products (or mixtures) are now banned in Canada, while three other substances were withdrawn from the canadian market by the manufacturers themselves. The remaining products are all tightly controlled in Canada, since they are thought to pose very serious risks to the health of humans and wildlife. Six of these products are bio-accumulable and have already been associated with the widespread mortality of raptorial and aquatic birds (P. Mineau, pers comm).

4.3 Hunting pressure and egg-collecting

Although we were unable to observe this activity ourselves, we met many Dominicans (public servants, fishermen and farmers) who told us that the hunting of colonial birds and the collection of their eggs are common in the Dominican Republic. Anonimo (1983) also mentions this problem. Great Blue Herons and egrets are considered pests and are hunted for their meat because they eat fish and com- mercial shrimps used for human consumption, whereas Cattle Egrets are not largely hunted because it is felt that they control insects in several types of crops, especially rice.

TABLE 4

List of main pesticides known to be toxic to vertebrates and still used in the Dominican Republic*

Products	Normal usage**	Bio-accumulation**	Status in Canada**
Insecticides & Nematocides			
DDT	Malaria control	Yes	Banned
Chlordane/Heptachlor	Termite control	Yes	Heptachlor banned
Aldrin/Dieldrin	Termite control	Yes	Use restricted
EDB/DBCP	Nematode control	No	EDB banned DBCP never used
Parathion	General insect control	No	Used
Aldicarb	Nematode control	No	Used
Monocrotophos (Azodrin, Monocion, Nuvacron)	Destroyers of cotton crops and control of birds in rice paddies	No	Never used
Lindane/Gamma HCH	Seed treatment	?	Used
Clordimeform (Galacion, Fundal)	Acarid control	Slight	Withdrawn by manufacturer
Herbicides			
Paraquat	Weed killer (monocotyledons and dicotyledons)	No	Used
2-4D/2,4,5-T (Agent orange)	Weed killer (Dicotyledons)	Dioxin Bio-accumulable	2,4,5-T withdrawn by manufacturer
Fongicides			
Mercurials	Seed treatment	Yes	Banned

* Source: Antonio Thomén (in lit.), Instituto Dominicano de Bio-conservacion, Santo Domingo, Dominican Republic.

** Personal communication with Pierre Mineau, Wildlife Toxicology and Surveys Branch, Canadian Wildlife Service, Hull.

5.0 CONCLUSION

Although the wetlands of the Dominican Republic account for only a small percentage of the country's total area, they are nonetheless of considerable importance to resident and migratory populations of wading birds. Since these types of habitat do not exist or have virtually disappeared from a number of the islands of the Antillean archipelago, those that remain are all the more important. This is particularly true in the case of water birds which contribute the largest share of the species richness of the islands.

In light of the present threat to the wildlife species of many Latin American countries (potential poisoning and poaching) and to their habitat (disappearance and deterioration of wetlands), we feel that it is becoming increasingly urgent to sign political agreements with these countries in order to ensure the survival of the migratory bird species we share with them.

ACKNOWLEDGMENTS

We would like to extend sincere thanks to the many Dominicans who shared their knowledge on the birds of the Dominican Republic with us, particularly Annabelle Stockton de Dod, Jose Alberto Ottenwalder and Tomas A. Vargas Mora, The latter, along with Benoit Floquet, provided us with data on the use of pesticides in the Dominican Republic. Appendix 4 gives a list of resource persons and organizations in the Dominican Republic who helped us with this study. This study received financial assistance under the Latin American Program of the Canadian Wildlife Service.

REFERENCES

Anonimo. 1983. Estudios en las areas silvestres de la Peninsula de Barahona e Isla Beata. Secretaria de Estado de Agricultura, Departamento de Vida Silvestre & Museo nacional de Historia natural, Dirrecion nacional de Parques, Santo Domingo, Dominican Republic, 296pp.

Anonimo. 1985. Résultarios agropecuarios 1985. Secretaria de Estado de Agricultura. Subsecretaria tecnica de planification agropecuaria. Departamento de planification. Santo Domingo, Dominican Republic.

Anonimo. 1986. Plan operativo 1987. Secretaria de Estado de Agricultura. Subsecretaria tecnica de planification agropecuaria. Departamento de planification. Santo Domingo, Dominican Republic.

Bond, J. 1971. Birds of the West Indies. Collins, London. 256pp.

Byrd, M. A. 1978. Dispersal and movements of six North American Ciconiiforms. pp. 161-186 In Sprunt IV, A., J.C. Ogden and S. Winckler (eds). Wading Birds. Reseach Report no. 7. National Audubon Society.

Hancock, J. and H. Elliot. 1978. The Herons of the World. Harper & Row. 304pp.

Hancock, J. and J. Kushlan. 1984. The Herons Handbook. Croom & Helm 4 Publ, London. pp.

Hartshorn et al. 1981. La Republica dominica: perfil ambiental del pais - Un estudio de campo. AID/05D/PDC-C-0247. 134pp.

Hernandez C. and T. Vargas. 1986. Dominican Republic. pp. 498-510 In Scott, D.A. and M. Carbonel. A directory of Neotropical Wetlands. IUCN Cambridge and IWRB Slimbridge.

Kushlan, J. A., G. Morales, and P. C. Frohring. 1985. Foraging niche relations of wading birds in tropical wet savannas. Neotropical ornithology - Ornithological Monographs 36:663-682.

Legendre, P. and A. Vaudor. 1982. R. Package for multivariate analysis. Université de Montréal. Département des Sciences biologiques.

Legendre, L. et P. Legendre. 1984. Écologie numérique. Tome I: Le traitement multiple des données écologiques; Tome II: La structure des données écologiques. 2 éd., Masson, Paris.

Palmer, R. S. 1962. Handbook of North American Birds (Vol 1). Yale University Press. 567 pp.

Stockton de Dod, A. 1981. Guia de campo para las aves de la Republica Dominicana. Santo Domingo, Dominican Republic, 254pp.

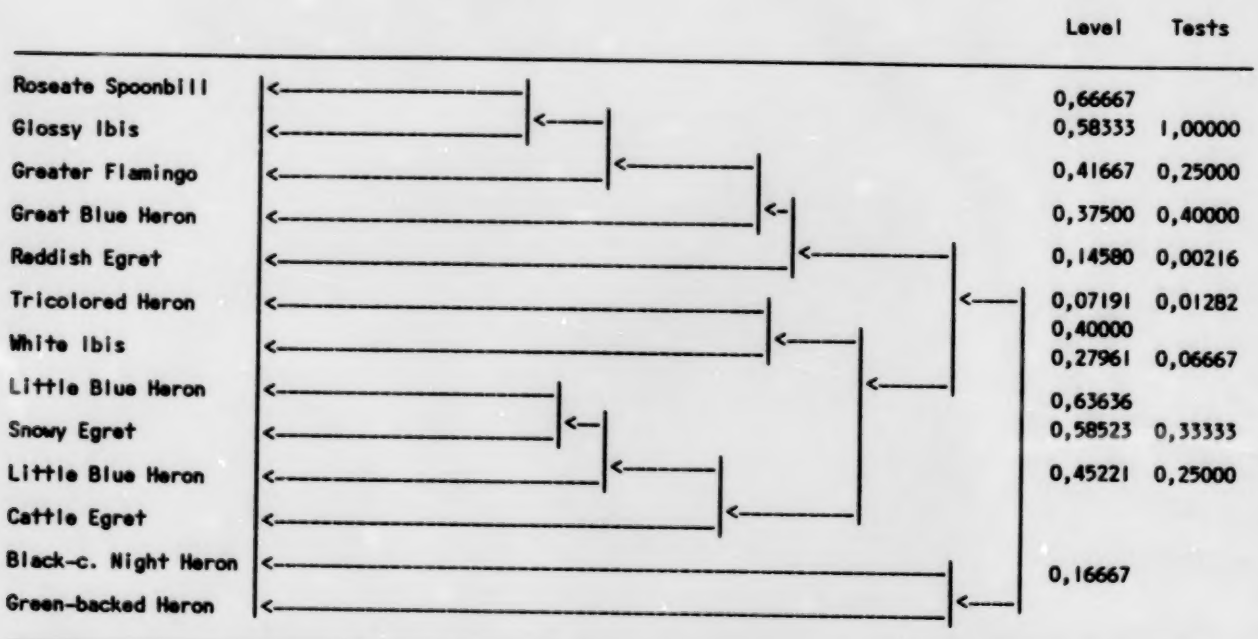
Stockton de Dod, A. 1987. Aves de la Republica Dominicana. Santo Domingo, Dominican Republic, 354pp.

Wetmore, A. and B. H. Swales. 1931. The Birds of Haiti and the Dominican Republic. Smithsonian Institute Bulletin 155.

Wetmore, A. 1932. Birds collected in Cuba and Haiti by the Parish-Smithsonian Expedition of 1930. Proc U.S. Nat. Museum 81(2):1-40.

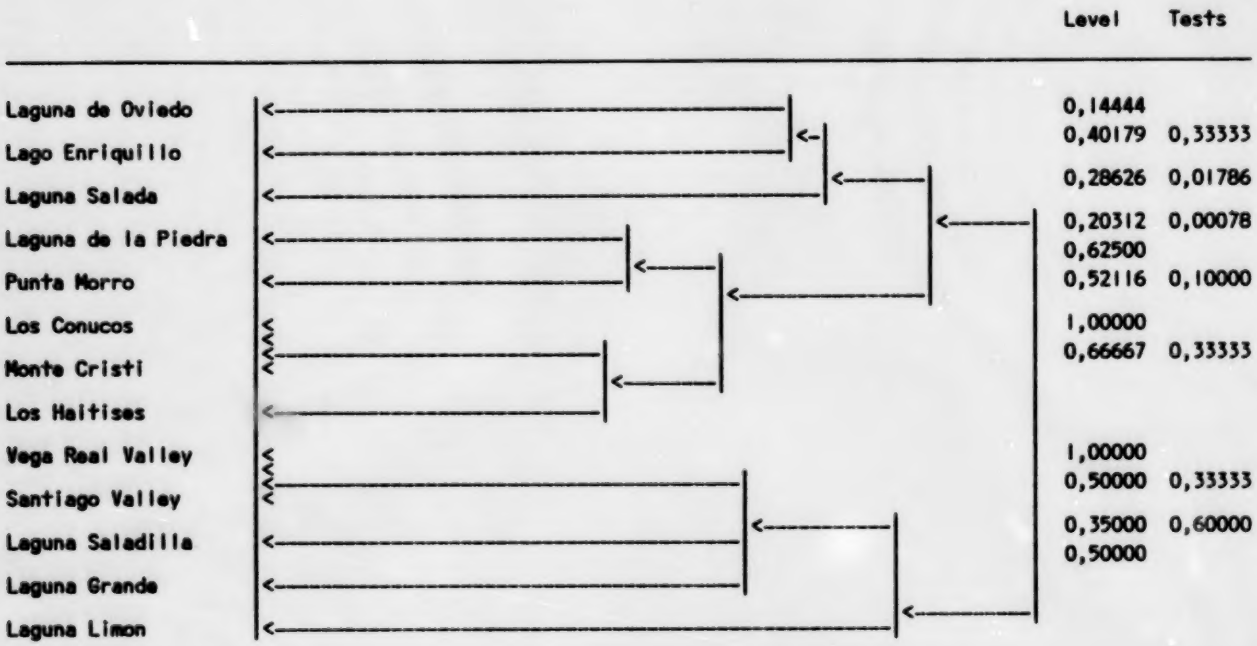
APPENDIX I

Dendogram of ecological groupings of wading birds



APPENDIX 2

Dendogram of ornithological similarities among the various wetlands visited



APPENDIX 3

List of aquatic bird species sighted in Dominican Republica between July 28 and August 6, 1987

NOMS SCIENTIFIQUES SCIENTIFIC NAMES	NOMS FRANÇAIS FRENCH NAMES	NOMS ANGLAIS ENGLISH NAMES	NOMS DOMINICAINS DOMINICAN NAMES
Podilymbus podiceps	Grèbe à bec bigarré	Pied-billed Grebe	Zaramagullon
Pelecanus occidentalis	Pélican brun	Brown Pelican	Alcatras, Pelicano
Fregata magnificens	Frégate superbe	Magnificant Frigatebird	Tijereta
Ardea herodias	Grand Héron	Great Blue Heron	Garzon Cenizo
Butorides striatus	Héron vert	Green-backed Heron	Cra-cra
Casmerodius albus	Aigrette bleue	Little Blue Heron	Garza Azul
Bubulcus ibis	Héron garde-boeufs	Cattle Egret	Garza Ganadera
Egretta rufescens	Aigrette roussâtre	Reddish Egret	Garza Rojiza
Egretta alba	Grande Aigrette	Great Egret	Garza Real
Egretta thula	Aigrette neigeuse	Snowy Egret	Garza de Rizos
Egretta tricolor	Aigrette tricolore	Tricolored Heron	Garza Pechiblanco
Nycticorax nycticorax	Bihoreau à couronne noire	Black-Crowned Night-Heron	Rey Congo
Plegadis falcinellus	Ibis luisant	Glossy Ibis	Coco Prieto
Endocimus albus	Ibis blanc	White Ibis	Coco Blanco
Ajaia ajaja	Spatule rosée	Roseate Spoonbill	Cuchareta
Phoenicopterus ruber	Flamant rose	Greater Flamingo	Flamenco
Dendrocygna bicolor	Dendrocygne fauve	Fulvous Whistling Duck	Yaguasin
Dendrocygna arborea	Dendrocygne à bec noir	West Indian Wistling Duck	Yaguaza
Pandion haliaetus	Balbuizard	Osprey	Guincho
Rallus longirostris	Râle gris	Clapper Rail	Pollo de manglar
Gallinula chloropus	Poule d'eau	Common morhen	Gallareta Pico Colorado
Jacana spinosa	Jacana roux	Northern Jacana	Gallito de Agua
Charadrius wilsonia	Pluvier de Wilson	Wilson's Plover	Cabezon
Charadrius vociferus	Pluvier kildir	Killdeer	Fraile
Pluvialis squatarola	Pluvier argenté	Black-bellied Plover	Playero nomada
Arenaria interpres	Tournepierre à collier	Ruddy Turnstone	Playero turco
Himantopus mexicanus	Échasse d'Amérique	Black-necked Stilt	Zancudo
Actitis macularia	Chevalier branlequeue	Spotted Sandpiper	Playerito manchado
Tringa melanoleuca	G. Chevalier à p. jaunes	Greater Yellowlegs	Playero Grande
Tringa flavipes	P. Chevalier à p. jaunes	Lesser Yellowlegs	Playero el menor
Calidris pusilla	Bécasseau semipalmé	Semipalmated Sandpiper	Playerito Patas Negras
Calidris minutilla	Bécasseau minuscule	Least Sandpiper	Playerito menor
Calidris melanotos	Bécasseau à p. cendrée	Pectoral Sandpiper	Playerito
Limosa haemastica	Barge hudsonienne	Hudsonian Goduit	Playero
Larus atricilla	Mouette à tête noire	Laughing Gull	Gaviota Cabecinegra
Sterna dougallii	Sterne rosée	Roseate Tern	Gaviota Palometa
Sterna antillarum	Petite Sterne	Least Tern	Gaviotica
Sterna maxima	Sterne royale	Royal Tern	Gaviota Real

APPENDIX 4

List of resource persons and organizations in the Dominican Republic.

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3. Annabelle Stockton de Dod
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4. Benoit Floquet, agronome
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5. Lic. Rosario Blanco de Firmin
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   Division Registro Pesticidas
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6. Dr. Antonio Thomen
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7. Centro Habitat
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8. Fumigacion Aereas S.A. (FASA)
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9. Eugenio de Jesus Marcano
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   Departamento de Biologia
   Universidad autonoma de Santo Domingo
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10. Museo nacional de Historia
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